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TECHNICAL
PUBLICATION

25X1

PHOTOINTERPRETER PRINT STATION

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NPIC/R-32/72
SEPTEMBER 1972

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TECHNICAL PUBLICATION

TEST AND EVALUATION REPORT

25X1 [redacted] PHOTOINTERPRETER PRINT STATION

(PIPS)

SEPTEMBER 1972

[redacted] 25X1

Test and Evaluation Branch
Engineering Support Division
Technical Services Group
NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

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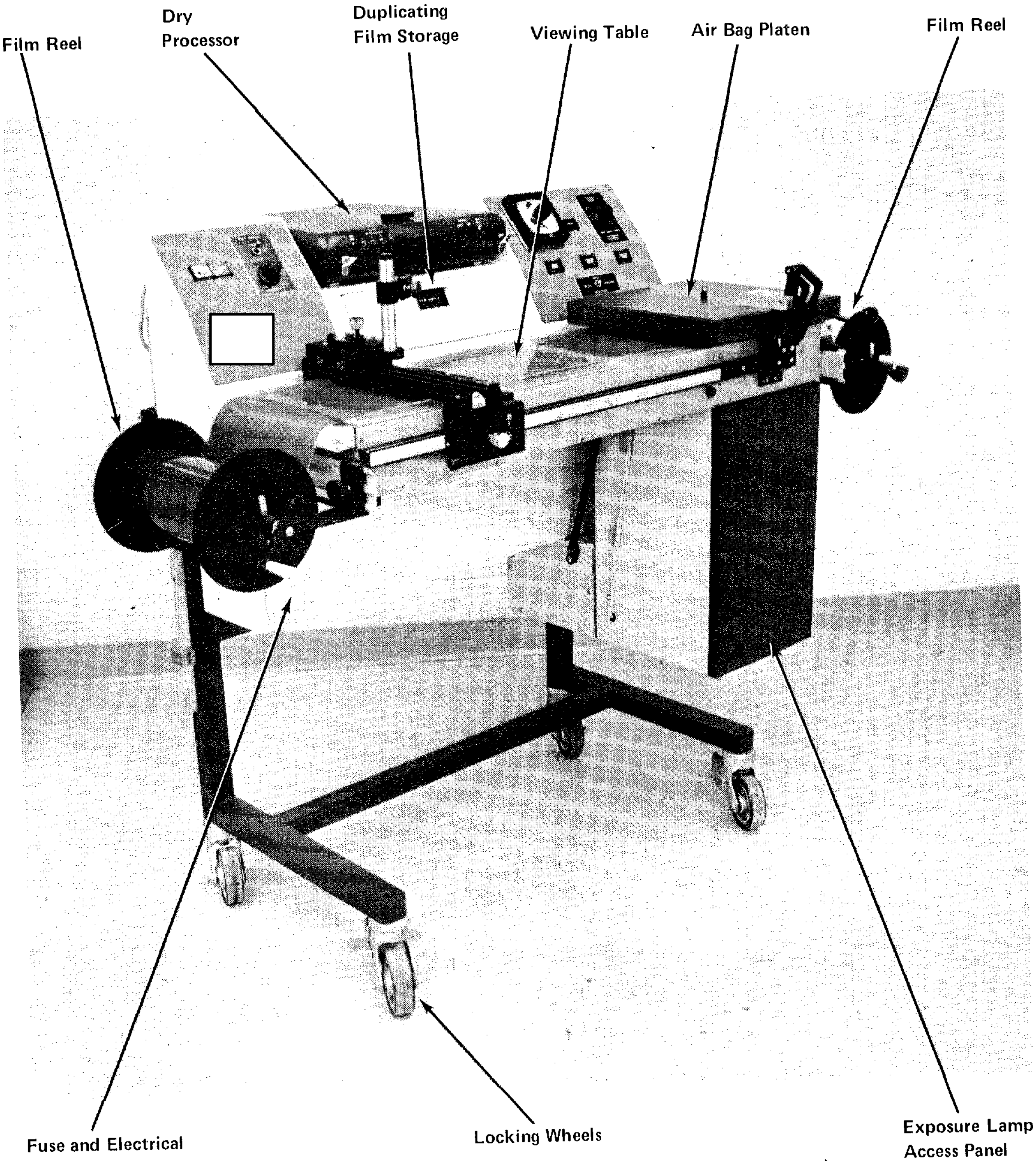

FIGURE 1. PHOTO INTERPRETER PRINT STATION (PIPS)

ABSTRACT

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The [redacted] Photointerpreter Print Station was developed to provide the capability of quickly producing high quality positive or negative film duplicates.

It was tested for contractual acceptance and equipment performance. In addition, operational and technical evaluations were performed.

It was concluded that the equipment met NPIC requirements, but that the minor discrepancies noted should be corrected in the event of additional procurement of this device.

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1. INTRODUCTION

1.1 Background

25X1 The Photointerpreter Print Station (PIPS), Fig. 1, was developed by the [redacted] 25X1 The purpose of the PIPS is to provide a system that will afford photointerpreters with the capability of making high resolution sheet film duplicates from roll or sheet film. This can be accomplished at close proximity to his work station under normal room light and provides for immediate use and/or retention of the duplicates.

A similar device, the [redacted] Rapid Interpretation Printer Processor (RIPP), had previously received limited operational use at NPIC. However, the RIPP soon fell into disuse. This was primarily due to less than acceptable quality of reproductions because of printer resolution and the noxious odors associated with the unit's ammonia processing system. 25X1

25X1 The [redacted] proposed to convert a RIPP, retaining certain components parts of the original device, to a printer processor utilizing 25X1 [redacted] Dry Diazo and Dry Silver films. The unit would employ an improved printer unit and film processor. The PIPS was delivered on 23 December 1971. Following the acceptance tests and technical tests and evaluation, a memorandum test and evaluation report was issued on 22 February 1972.

The processing oven malfunctioned on two different occasions during the operational evaluation portion of the test program and an earlier model oven was temporarily substituted for the original which was returned to [redacted] for repairs. 25X1 The manufacturer elected to modify the oven in order to improve its utility while the unit was at their facility. The need for these changes was made known to the RED Project Monitor in a memorandum test report. The processor was retested in the final configuration. This report reflects these latest modifications.

Operational evaluations were conducted by all NPIC and tenant operating components. They were completed in April 1972. Their comments are included in Sec. 5.2.

1.2 Test Objectives

Test plan objectives accomplished include: 1) testing to contractual requirements or design goals, 2) operational evaluation by all components and tenants, and 3) performance testing and technical evaluation.

2. SUMMARY OF TEST RESULTS

2.1 Acceptance Tests

Acceptance testing was performed to determine whether the development objectives and/or design goals were met. The following paragraphs summarize the particular tests or inspections that were performed.

2.1.1 Visual Inspection. The visual inspection showed that all the required modifications to the original RIPP table have been accomplished. These modifications now constitute the new PIPS.

2.1.2 Uniformity of Illumination. The printer uniformity of illumination meets the design goal of no more than 10% fall off from center to the corners of the format.

2.1.3 System Resolution. Resolution tests were performed with Dry Diazo film of the same lot used during preacceptance tests at the contractor's facility. All the target arrays printed exceed the contractual requirement. Three exposures of the 17 target array yielded an average of 307 cycles per millimeter (c/mm) with the lowest being 256 c/mm. Eighty-six percent (44 of 51) of the individual targets within the arrays printed had resolutions of 286 c/mm or better.

2.1.4 Exposure Time. The printer met the requirement for this test. The PIPS can produce a copy of a 1.0 density original with an exposure of 90 seconds or less.

25X1 2.1.5 Comparison of Exposures Systems. A comparison of the test results of the [redacted] RIPP and [redacted] PIPS printers showed that uniformity of illumination is not as even on the PIPS as on the RIPP printer. However, it is within the design goal of the equipment. Resolution readings are much higher on the PIPS. They exceed contractual requirements. 25X1

2.1.6 Processing Time. The processing oven can process type 788 Dry Diazo material in less than 1.5 minutes, which was within the design goal.

2.1.7 Power Requirements. The maximum current drain measured 17.1 amperes at 120 volts. This reading is below the limit called out in the contract specifications.

2.2 Operational Evaluation

All components found the PIPS to be suitable for operational use. The results of their evaluations, which included both favorable and unfavorable comments, are listed below:

- Good to high quality reproductions with the positive and negative films.
- The positive diazo film lacks the density range required for good reproductions. Information is lost in the highlights and shadows. (Reported by APSD/TSG Photo Technologists.)
- The equipment has varied utility.
- The unit is easy to use.
- The printer blower is noisy.
- The segmented rollers can scratch film.
- The printer backlighting should be brighter.
- It is difficult to determine the optimum exposure.
- Film drive motors should be added (one component only).

2.3 Performance Tests

2.3.1 Additional Resolution Tests. These tests were conducted on the Dry Diazo and Dry Silver films which were delivered with the PIPS. Average resolution readings for the Dry Diazo film fell within the range of 243 to 286 c/mm. The resolution readings for the Dry Silver were within the range of 292 to 302 c/mm.

2.3.2 Contact Uniformity. No evidence of poor contact between the original imagery and the film duplicate was noted.

2.3.3 Air Bag Inflation. The printer achieves maximum resolution over the full format area when the bag is inflated such that a force of 18 pounds is required to lock the printer platen. A small air pump and a spring scale are required to periodically check and maintain the correct air bag inflation.

2.3.4 Platen Backlighting. Platen backlighting is used as an aid to positioning film. The luminance measured a maximum of 37 footlamberts (fL). This was below the 100 fL of reflected room light falling on the platen.

2.3.5 Blower Noise. Blower noise during the exposure and lamp cool down cycle exceeded the NC-45 Noise Curve which is frequently used as a upper limit in specifications for other NPIC photointerpretation equipment. The blower noise reached its maximum level during lamp cool down. Additionally, on and off cycling of the blower after termination of exposure may be a source of annoyance to the operator.

2.3.6 Comparison of Printer Timers. A comparison of sensitometric test data showed the photric timer to be more sensitive to line voltage variations than was the mechanical timer because it does not employ a regulated power supply. This resulted in greater exposure variations than those which were obtained with the mechanical timer. Tests showed the mechanical timer to be accurate to within 0.7 second over the full range of exposure times.

2.3.7 Processing Uniformity. Dry Silver film test samples were exposed by a uniform diffuse light source and processed in the PIPS processor oven for the 1.5 minute time period as recommended by the manufacturer. Variations in the densities of each sample were found to be no greater than 0.07 when measured within the test zones of the format area.

The maximum temperature differential over the format area measured 15.5° F. Evidently this temperature variation is not enough to affect the film density.

2.3.8 System Density Variation. Dry Silver test samples were exposed with the PIPS printer and processed in the PIPS oven. Variations in the densities of each sample ranged up to 0.24 when measured within the test zones of the format area. This nonuniformity results from the illumination fall off at the corners of the printer platen. (See para. 2.1.2 and 2.1.5.)

2.3.9 Processor Timer. The processor timer accuracy varies by no more than 5 seconds over the full range of dial settings. The timer is not affected by variations in line voltage.

2.3.10 Processor Temperature Controller. The processor reaches initial thermal equilibrium after 10 minutes of operation. If the lid is held open for 10 seconds and then closed, it will recover thermal equilibrium in 1 minute 40 seconds. The processor temperature adjustment potentiometer is too sensitive. One turn of this control varies the temperature setting from 106° F to 283° F.

2.4 Technical Evaluation

2.4.1 Physical Measurements. The unit is 33.5 inches in depth and will not pass through the 32-inch-wide vault doors located in some areas within [redacted] 25X1

2.4.2 Controls. Operation of the PIPS can be further simplified by certain modification to the controls. (See para. 5.4.2.)

2.4.3 Safety. A protective cover is needed on the platen latching and locking mechanism to prevent the operator from pinching his free hand.

2.4.4 Operation and Maintenance Manual. The manual contains the necessary operator information, but the maintenance portion contains drawing errors and is incomplete.

2.4.5 Maintainability and Reliability

- Accessibility of most components is generally good, but some cable rerouting is indicated. Fuses should be externally accessible.
- There was no evidence of printing light fall off due to lamp ageing during the testing program.
- Some means other than foam back tape is needed to secure the processor to the mounting surface.
- The microstereoscope mounting post must be mounted backward because of interference with the rear panel. It is awkward to use the microstereoscope translation controls in this position.

2.5 Materials Tests

Photo Technologists from APSD/TSG found that the Dry Silver film (Lot 23-01) yielded higher quality reproductions than did the Dry Diazo film (Lot 28-01).

Maximum film shrinkages of 0.61% (Dry Diazo) and 0.46% (Dry Silver) were measured. [redacted] claims 0.03% maximum shrinkage for 0.004-inch thick estar base SO.135.) 25X1

3. CONCLUSIONS AND RECOMMENDATIONS

The PIPS met its development objectives and design goals. It is of good design and construction and can consistently produce copies of transparencies which are suitable for photointerpreter use at NPIC.

The equipment, in its present configuration, can be used in an operational environment. However, in the event of additional equipment procurement, it is recommended that the minor discrepancies summarized in section 2.0 be changed or corrected to increase utility.

4. DESCRIPTION OF EQUIPMENT

4.1 Introduction

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The PIPS is a self-contained device consisting of a heat processor oven (Figs. 2 & 3), a printer and associated controls (Figs. 4 & 5), and a [redacted] Model 940 MCE Light Table assembly on which these units are mounted. The Light Table and a glass platen in the printer unit are the only portions of the RIPP which have been retained for use in this development.

25X1 25X1

[redacted] 7889 Diazo positive-acting film is used whenever a positive-to-positive or negative-to-negative (nonreversing) image transfer is required. [redacted] 7969 Dry Silver negative-imaging film is used whenever a positive-to-negative or negative-to-positive (reversing) image transfer is required. Both of these materials are useable in normal room light. They are exposed with near ultraviolet light and are processed by the application of controlled heat. The manufacturer's D-Log E Curves are shown in Figs. 10 & 11.

4.2 Printer Assembly

A mechanical print timer, as contractually required, is furnished with the PIPS. In addition, a Photric Timer is also supplied as a possible alternate. This device uses a photo detector and appropriate electronic circuitry to integrate the total printer light output with respect to time, thus assuring (in theory) more uniform repetitive print exposures. The desired timer is selected by means of a mechanical switch. Contact uniformity between the raw film material, the original imagery, and the glass printer platen is achieved through use of a low-pressure inflated air bag. A one-hand-operated latching and locking device forces the air bag down and holds the film in close contact.

A circline lamp and diffuser are supplied to backlight the imagery for orientation on the platen. This lamp extinguishes and the diffuser swings out of the way whenever the air bag is locked down.

Whenever the print button is depressed, a small motor actuates a pair of contacts repetitively and triggers a high voltage transformer to pulse high voltage across the electrodes of a metal halide arc lamp, which provides the printer point source illumination. At the same time, the normal ballast is energized. As the lamp lights, a photo cell interprets this light and de-energizes the starting pulse circuitry. The main ballast brings this lamp up in an over-driven manner to provide quick brilliancy. During this time the lamp temperature sensor is controlling a direct current blower which maintains a desirable lamp envelope temperature throughout the lamp exposure cycle. At the completion of the exposure, the blower goes to full speed to cool the lamp envelope for the next exposure.

4.3 Heat Processor

The processor is a compact oven with the general appearance of a large "waffle iron." It has a hinged lid which is lifted to insert the exposed film. The lid is restricted from full opening in order to prevent excessive flexing of the electrical cable routed to the solid state temperature controller and timer circuitry mounted in the box attached to the lid.

The unit initially draws high current for quick warmup, but when warmup is completed current drain is reduced. The processor is interlocked with the printer during warmup to prevent the printers use, thereby preventing excessive current drain. The processor has two parallel heating plates, one mounted in each section. A film support is positioned between them so that film does not come in contact with the heaters.

The continuously variable timer control can be manually set for any desired processing time from 30 seconds to 3 minutes. The timer begins to time the processor when the lid is first closed. This time is divided into four equal parts and displayed by indicator lights located on the lid. Whenever the desired processing time is attained, the timer emits an audible buzz which continues until the lid is lifted for removal of the film.

5. TEST DETAILS

5.1 Acceptance Tests (Reference: [redacted] Technical Proposal for Modification of a RIPP Table for [redacted] Dry Processed Photo Material, dated October 1970.) 25X1

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This acceptance test details section describes the contractual requirements or design goals, test method, test results, and conclusion for each characteristic or quality listed in the work statement of the technical proposal.

5.1.1 Visual Inspection

Contractual Requirements	Results
A low pressure air bag will be substituted for the foam pad used for applying pressure during exposure.	Conforms
A positive latching, one-hand operation locking device will force the bag down and hold it in place.	Conforms, but see Sec. 5.4.3
The control panel will be modified to accommodate the new functions necessary.	Conforms
The existing exposure light source, pressure system, and ammonia processor will be removed from the table and returned to the customer or discarded, as required.	Conforms
Existing controls for viewing portions of table will be kept.	Conforms
Image format shall be 9-1/2 inches square. Film size 9-1/2 inch square or 9-1/2 inch x 10-1/2 inch will be usable on the device.	Format measured 10 inches square

Contractual Requirements	Results
A manually set timer with an audible signal will be furnished for determining processing time.	Conforms
Temperature adjustment shall be an internal control accessible without disassembling machine.	Conforms. Adjustment located below plug in outer case.
A new processor module will be permanently affixed to the table for processing brand type 788 and 796 dry processing materials.	Conforms, but see sec. 5.4.6

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5.1.2 Uniformity of Illumination. Design goal for uniformity of illumination shall be no more than 10% fall off from center to corner (of format). Less than 20% shall be guaranteed.

Test Method

The light source was allowed to reach maximum intensity. The illumination was then measured using a Spectra Foot Candle Meter X-100 at each of the four corners and the center of the image format.

Test Results

TABLE 1. Printer Illumination Measurements

LOCATION	ILLUMINANCE (FOOT CANDLES)	PERCENTAGE FALL OFF
Upper Left	900	10
Lower Left	950	05
Center	1000	--
Upper Right	900	10
Lower Right	950	05

Conclusion

The uniformity of illumination met the design goal.

5.1.3 System Resolution. Average system resolution with type 788 (Dry Diazo) over the 9-1/2-inch format shall be 200 c/mm or greater for 17 target arrays of negative USAF 1951 High Contrast Test Targets.

Test Method

Copies of the test targets were produced using type 788 (Lot 22-02) material which was used for preacceptance tests at the manufacturer's facility. This film was exposed for 45 seconds and processed for 2 minutes in order to achieve the highest obtainable resolution readings. The highest frequency available on this test target is 323 c/mm. The format layout of the targets is shown in Fig. 6. Copies of the targets were evaluated with a [redacted] Biological Microscope. Results of this test with the above-mentioned material are reported below. Additional resolution tests were made with Dry Silver material and Dry Diazo material of different lots and are reported in Sec. 5.3.1.

25X1

Test Results

TABLE 2. [redacted] Type 788 Dry Diazo Film (Lot 22-02)
SYSTEM RESOLUTION

25X1

TARGET POSITION	SAMPLE 1 c/mm	SAMPLE 2 c/mm	SAMPLE 3 c/mm
1	323	323	323
2	287	323	287
3	323	323	287
4	287	323	287
5	287	287	287
6	256	287	287
7	287	287	323
8	256	256	323
9	287	256	323
10	287	287	228
11	287	323	287
12	287	287	256
13	287	287	287
14	287	287	287
15	323	323	287
16	256	287	323
17	323	323	323
*	290	317	313

*AVERAGE VALUES

Conclusion

The System Resolution exceeds contractual requirements.

5.1.4 Exposure Time. Exposure time shall be no longer than 90 seconds to achieve a 1.0 average density.

Test Method

A previously exposed and processed film transparency of densities ranging from 0.95 to 0.98 was placed on the platen. Type 788 (Lot 22-02) material was exposed through the transparency for 90 seconds and then processed for 2 minutes. The film was measured with a [redacted] Densitometer to determine if the density was 1.0 or less. Because this is a reversal material, greater exposures will produce lower densities.

25X1

Test Results

TABLE 3. Sample Densities at 90-Second Maximum Exposure Time

(Type 788 Material)

Sample Number	Transmission Density Range
1	0.84 - 0.90
2	0.85 - 0.90
3	0.80 - 0.90

Conclusion

Meets requirements. Film densities of 1.0 or less can be achieved with exposure times of 90 seconds or less.

5.1.5 Comparison of Exposure Systems. A new exposure system will be provided to give better uniformity of illumination and higher resolution.

Test Method

Resolution and the uniformity of illumination were measured on a [redacted] RIPP Table [redacted] and compared to the [redacted] PIPS test results reported in para. 5.1.2 and 5.1.3. In addition, uniformity of contact between input materials (which affects resolution measurements) was measured using USA Standard Z38.7.5 - 1948 as a guideline.

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Test Results

TABLE 4. Comparative Results - [redacted] PIPS and [redacted] RIPP Printers 25X1 25X1

NOMENCLATURE	UNIFORMITY OF ILLUMINATION (Maximum Fall Off)	RESOLUTION (Average over Format)
[redacted] - RIPP	None Detected	108 c/mm
- PIPS	10%	307 c/mm

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The uniformity of contact tests showed small areas of poor contact over much of the [redacted] RIPP format. This problem was caused in part by trapped dust particles. A repeat of these tests on the [redacted] PIPS showed even contact over the full format. 25X1 25X1

Conclusion

The comparison of test results of the [redacted] RIPP and [redacted] PIPS printers showed that uniformity of illumination is not as even on the PIPS as on the RIPP printer. However, it is within the design goal of the equipment. The PIPS, with its point light source and air bag, achieves higher resolution than is obtainable with the RIPP light grid and flexible sponge pressure pad combination. 25X1 25X1

5.1.6 Processing Time. Processing time in the range of 1 to 2 minutes is acceptable.

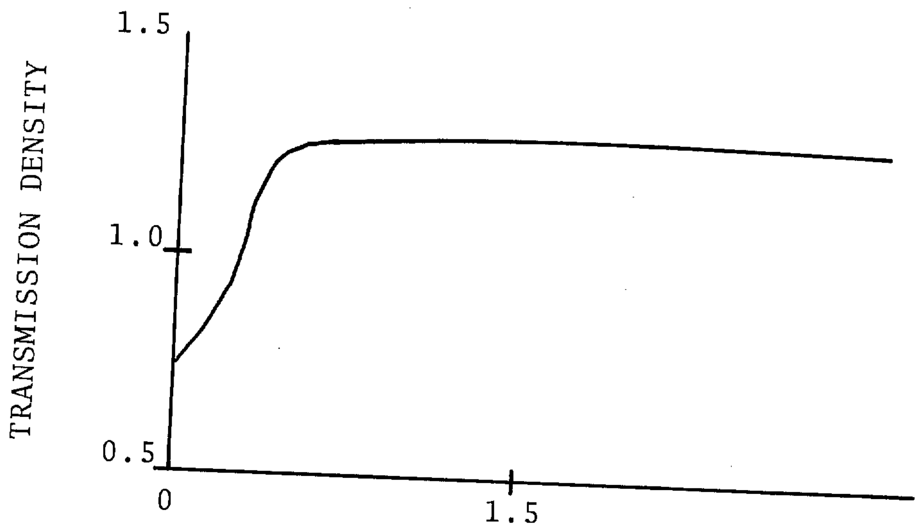
Test Method

Unexposed samples of type 788 Dry Diazo were processed for various times from 1 minute to over 2 minutes. Their resulting densities were read with a densitometer.

Test Results

Approximate Density Versus Processing Times

25X1 [redacted] Type 788 Dry Diazo Material



Processing Time - In Minutes

Note - Materials processed in center of oven format
Oven Temperature 260° F.

Conclusions

Meets requirements. The processing oven can process type 788 Dry Diazo material in less than 1.5 minutes.

5.1.7 Power Requirements. Power requirements shall be kept as low as possible. Preferably below 20 amperes at 120 VAC.

Test Method

The voltage, current, and power dissipation of the equipment was measured during the various operating modes with [redacted] Test Instruments. 25X1

Test Results

TABLE 5. Power Requirements - [redacted] PIPS 25X1

FUNCTION	OPERATING CURRENT (AMPERES)	POWER DISSIPATION (WATTS)
Standby (Light Table, Panel Lamps, and Processor Cycling)	2.9	362
Printing (Lamp at maximum brightness)	17.1	1970

Conclusion

Meets requirements.

5.2 Operational Evaluation

All NPIC and tenant Operational Components conducted their evaluations of the PIPS. Their findings, which include both favorable and unfavorable comments, are listed below.

All components were pleased with the overall operation of the equipment and found it suitable for their operational use.

- Good to high quality reproductions with both positive and negative materials. (Reported by Photointerpreters in the operating components.)
- The negative dry silver material produces a good image. However, the positive diazo film lacks the density range required for good reproductions. Information is lost in the highlights and shadows. (Reported by Photo technologists in APSD/TSG.)
- The unit is easy to use.
- The equipment has varied utility, e.g.; it can be used to produce positive and negative transparencies, view graphs and negatives to be used in making quick briefing enlargements.

- The printer blower is noisy.
- The segmented rollers can scratch the film.
- Film drive motors should be added (APSD/TSG only).
- The printer backlighting should be brighter.
- It is difficult to determine the optimum exposure without making repeated trial and error exposures.

5.3 Performance Tests

5.3.1 Additional Resolution Tests. Resolution tests were performed with Dry Diazo Lot 28-01 and Dry Silver Lot 23-01. These materials were delivered with the PIPS and used exclusively throughout the testing program with the exception of the acceptance test.

Test Method

These tests were performed following the same procedure used in the acceptance tests. The Dry Diazo film was exposed for 1 minute and processed for 2 minutes. The Dry Silver film was exposed for 0.5 minutes and processed for 1-1/2 minutes.

Test Results

TABLE 6. SYSTEM RESOLUTION

TARGET POSITION	Dry Diazo Lot 28-01 Sample 1 c/mm	Sample 2 c/mm	Sample 3 c/mm	Dry Silver Lot 23-01 Sample 1 c/mm	Sample 2 c/mm	Sample 3 c/mm
1	287	323	323	256	323	323
2	282	287	256	323	287	287
3	323	323	256	287	287	323
4	256	256	287	256	256	323
5	256	228	256	287	287	287
6	256	256	256	287	287	287
7	287	256	287	323	323	287
8	256	228	256	323	287	323
9	256	203	228	287	287	287
10	256	203	203	287	287	256

TABLE 6. System Resolution
(Continued)

TARGET POSITION	Dry Diazo Lot 28-01 Sample 1 c/mm	Sample 2 c/mm	Sample 3 c/mm	Dry Silver Lot 23-01 Sample 1 c/mm	Sample 2 c/mm	Sample 3 c/mm
11	287	287	287	256	287	287
12	256	203	256	287	287	323
13	181	203	228	287	323	323
14	256	203	287	323	323	323
15	228	256	323	287	323	323
16	256	228	287	323	323	287
17	287	203	287	287	287	323
*	263	243	268	292	295	302

*Average Resolution

5.3.2 Contact Uniformity. This test was to determine if the air bag provides uniform contact between the original imagery and the film duplicate. Poor contact is caused by air bubbles trapped between the two materials which can result in the degradation of the copied imagery.

Test Method

This test was conducted as per USA Standard Z38.7.5 - 1948. A contact transparency was made from 120 line per inch engravers screen. This transparency was examined to detect any departure from a uniform gray tone, which would indicate poor contact.

Test Results

The test transparency showed no evidence of poor contact.

5.3.3 Air Bag Inflation. This test determined the optimum amount of air bag inflation for maximum printer resolution. Since under inflation can degrade printer performance and over inflation may break the glass, some means of determining the optimum degree of inflation of the bag is required. The test established this means and provides a method for periodically checking to determine if a significant amount of air has escaped the bag.

Test Method

A quantity of air was allowed to escape from the bag and the printer resolution was then measured using the methods previously discussed. Small quantities of air were added to the bag until no additional increase in resolution occurred. A "Hunter" spring scale was then attached to the latching and locking lever. Force was applied at 90° to the end of the lever arm through the spring scale.

Test Results

Maximum force is applied just before the mechanism locks the air bag into position. The force required for optimum printer resolution is 18 pounds. The air bag should be checked periodically for possible loss of pressure.

5.3.4 Platen Backlighting. This test measured the backlighting produced by the printer for positioning of imagery on the platen.

Test Method

25X1 The luminance of the printer platen was measured with a [redacted] Model 759 Foot Lambert Meter at each of the four corners and the center of the format.

Test Results

TABLE 7. Printer Platen Backlighting

Location	Luminance (Foot Lamberts)
Upper Left	20
Upper Right	20
Center	37
Lower Left	22
Lower Right	27

Subjectively, observation of backlighted imagery showed that the brightness is insufficient for positioning of film.

5.3.5 Blower Noise. Blower noise measurements were recorded during the exposure cycle and during lamp cool down.

Test Method

Loudness measurements were obtained with a [redacted] 25X1
25X1 [redacted] Model 8051A Loudness Analyzer. The microphone was

positioned directly in front of the PIPS and 5 feet from the floor to simulate an operators normal working position. The test results were plotted and compared to a NC-45 Noise Curve.

The NC-45 Noise Curve was chosen because it is currently used as an upper limit in specifications for NPIC photo-interpretation equipment.

Test Results

The Blower Noise output of the PIPS exceeded the NC-45 Noise Curve limit during printer exposure and during the lamp cool-down cycle (see Figs. 8 & 9).

5.3.6 Comparison of Printer Timers. The two printer timers provided on the PIPS were tested to determine their operating characteristics. The most significant test data has been combined and presented here to provide a more comprehensive comparison for the reader.

Test Method

Step wedges were reproduced on the PIPS and their densities were read with a [redacted] Transmission Densitometer. 25X1
Line Voltage input to the equipment was closely controlled with a regulated power supply. Exposures were made at 117 VAC, 105 VAC, and 130 VAC. These latter two voltage values represent the worst case condition for the equipment (117 VAC ± 10%).

Test Results

TABLE 8. Exposure Repeatability at 117 VAC-Photric and Mechanical Timers

Type 7889 thermatone processed 2 minutes in PIPS processor.

TABLE 8. Exposure Repeatability at 117 VAC-Photric and Mechanical Timers (Continued)

Tablet Step No.	PHOTRIC TIMER (55 Unit Exposure) Sample No. 1	2	3	4	MECHANICAL TIMER (One Minute Exposure) Sample No. 1	2	3	4
1	.11	.12	.10	.10	.08	.10	.09	.08
5	.80	.79	.78	.78	.74	.74	.74	.72
10	1.22	1.23	1.24	1.22	1.20	1.18	1.19	1.20

TABLE 9. Exposure Repeatability at 105 VAC and 130 VAC - Photric and Mechanical Timers

Type 7889 thermatone processed 2 minutes in PIPS processor

	PHOTRIC TIMER (55 Unit Exposure) Input Voltage				MECHANICAL TIMER (One Minute Exposure) Input Voltage			
	105 VAC Sample		130 VAC Sample		105 VAC Sample		130 VAC Sample	
Tablet Step No.	1	2	1	2	1	2	1	2
1	.30	.25	.06	.11	.10	.08	.07	.06
5	.98	.96	.55	.78	.78	.74	.61	.61
10	1.29	1.26	1.15	1.20	1.20	1.22	1.15	1.14

Both timers performed adequately at controlled input voltage of 117 VAC. Variation in line voltages to maximum or minimum values causes exposure variation with both timers, although the variations obtained with the Photric Timer were greater.

5.3.7 Mechanical Timer Calibration. In addition to the sensitometric tests, the mechanical timer was visually checked for both accuracy and repeatability.

Test Method

Exposure times were measured with a stop watch by visually observing reflected light from the printer. The five indicated exposure times presented here span the range of this control setting.

TABLE 10. Mechanical Timer Visual Test Results

Nominal Time (Seconds)	Average Observed Time (Seconds) For Two Exposures
15	15.6
30	30.3
60	61.0
120	120.7
180	179.5

5.3.8 Processing Uniformity. These tests measured the heat distribution characteristics of the PIPS processing oven to determine if density variations obtained with type 796 Dry Silver Film were caused by variations in temperature in the film processor. Density variations may have resulted from variations in oven temperatures, because this material is sensitive to processing temperature differences.

Test Method

A uniform exposure was obtained by exposing the type 796 film to normal room light for a period of 9 minutes. These materials were processed in the PIPS oven for 1.5 minutes. This produced a processed transparency of approximately 1.0 density. Temperature measurements were taken after the oven reached heat stabilization within the area in which the film is processed. These measurements were made with an 25X1
Thermistor Thermometer.

Test Results

TABLE 11. Temperature Variations Within Format Area - PIPS Processor Oven

POSITION	TEMPERATURE (Degrees Fahrenheit)
Upper Left	248.0
Upper Right	253.5
Center	260.5
Lower Left	249.0
Lower Right	245.0
Maximum Temperature Variation from Center Test Position	15.5

TABLE 12. Density Variation - Type 796 Dry Silver Film Exposed for 1.0 Density in room light. See Fig. 6 for layout of the test zones on format.

POSITION	DENSITY SAMPLE 1	DENSITY SAMPLE 2
1	1.02	1.04
2	1.02	1.04
3	1.02	1.00
4	1.03	1.05
5	1.04	1.04
6	1.04	1.04
7	1.03	1.08
8	1.03	1.06
9	1.04	1.04
10	1.06	1.04
11	1.04	1.03
12	1.04	1.06
13	1.04	1.06
14	1.05	1.07
15	1.02	1.05
16	1.02	1.05
17	1.00	1.04
Sample Density Variation Over Format	0.06	0.07

The 15.5° F temperature variation over the format shows little affect on the density of the sample.

5.3.9 System Density Variation. This test determined if the printer illumination fall off (see paragraph 5.1.2) caused density variations in the transparency.

Test Method

Same as para. 5.3.8 except that the 1.0 density exposure was made with the PIPS printer.

Test Results

TABLE 13. Density Variation - Type 796 Dry Silver Film Exposed for 1.0 Density with PIPS Printer.

POSITION	DENSITY SAMPLE 1	DENSITY SAMPLE 2
1	0.78	0.80
2	0.84	0.86
3	0.72	0.75
4	0.88	0.93
5	0.90	0.93
6	0.88	0.92
7	0.90	0.93
8	0.93	0.96
9	0.95	0.98
10	0.93	0.96
11	0.90	0.90
12	0.94	0.97
13	0.95	0.98
14	0.94	0.98
15	0.88	0.94
16	0.92	0.99
17	0.84	0.90
Sample Density Variation Over Format	0.23	0.24

When tables 12 and 13 are compared, it can be seen that sample density variations are caused by printer illumination fall off and not by the temperature variation within the processing oven.

5.3.10 Processor Timer. These tests determined the operating characteristics of the timer. The timer accuracy and the buzzer noise intensity were measured.

Test Method

Time was measured using a stop watch. A minimum of three measurements were made at each setting. The buzzer intensity was measured with a General Radio Sound Level Meter placed directly in front of the equipment and 60 inches from the floor.

Test Results

TABLE 14. Processor Timer Accuracy

Nominal Set Time On Dial (Minutes)	Average Measured Time (Minutes)
0.5	0.47
1.0	1.06
1.5	1.48
2.0	2.03
2.5	2.53
3.0	3.12

Variation of the 117 VAC Line Voltage by ± 10% showed no change in the timers operating characteristics.

Buzzer Noise Intensity

The buzzer noise intensity measured 71DB on the A-weighted scale. This is satisfactory.

5.3.11 Processor Temperature Controller. These tests determined the heating control characteristics of the processor.

Test Method

These observations and measurements were made with the aid of a Thermocouple Thermometer and a stop watch.

25X1

Test Results

The "quick warmup" circuit is deactivated in approximately 3 minutes 18 seconds after initial processor turn on.

The processor reaches initial thermal equilibrium after 10 minutes of operation. When the processor lid is held open for 10 seconds and then closed, the internal temperature drops from 260° to 210° F. The processor recovers thermal equilibrium in 1 minute 40 seconds. This test simulated the operator opening the lid and inserting material for normal processing.

The internal processing temperature can be set to the desired value by a single turn continuously variable potentiometer. This screwdriver adjustment allows temperature regulation over the range of 106° F to 283° F.

5.4 Technical Evaluation

5.4.1 Physical Measurements

Dimensions (Inches)

WIDTH :	54.2 Overall 43.0 With Film Brackets Removed
DEPTH :	33.5
HEIGHT :	54.0 Raised 47.2 Lowered
WEIGHT :	380 Pounds

COMMENT

The unit will not pass through the 32-inch-wide vault doors located in some areas within [redacted] 25X1

5.4.2 Controls. The operator's controls on the equipment are straightforward. However, they can be further simplified by replacing the separate On button and Off button with a single ON-OFF button. The exposure cycle can be initiated automatically by a switch after the diffuser swings out of the way thus eliminating the manual print button.

5.4.3 Safety. An operator can pinch his free hand in the platen latching and locking mechanism. Therefore, the mechanism should have a protective cover. An appropriate warning sign has been affixed adjacent to the mechanism as an interim measure.

The PIPS leakage current was measured to ANSI standards with a [redacted] Model 229 leakage current tester. Maximum leakage current measured 1.17 milliamperes. Although this exceeds the ANSI standard of 0.75 milliamperes, a three-wire 20-ampere power cord is provided. An attached warning sign cautions against operating without adequate ground connections.

25X1

5.4.4 Operation and Maintenance Manual. The manual is well written in that it provides the necessary information to enable an operator to correctly use the PIPS. The overall system schematic diagram is well drawn and easy to use in troubleshooting. However, the schematic diagram which contains the subassemblies is incomplete. There is no drawing of the processor circuitry. The Photric Timer schematic is drawn incorrectly. In addition, information pertaining to replacement parts is not included.

5.4.5 Maintainability. The PIPS was inspected for maintainability by NPIC maintenance personnel. Their comments are listed below.

- Accessibility of electrical components is generally good. However, cable routing within the lower electrical compartment would make replacement of some components extremely difficult.
- Maintenance of the unit falls well within the capabilities of this office.
- Fuses should be more accessible instead of inside the lower electrical compartment.

5.4.6 General. Examination of the comparative test data (para. 5.3.5) shows that the Photric Timer gives greater density variation than the Mechanical Timer whenever the input voltage is varied by plus or minus 10%. This problem can at least partially, if not fully, be attributed to the fact that the Photric Timer circuitry does not employ a regulated power supply. This causes voltage variations at the timer output which affect exposure.

The mercury arc lamp showed no signs of light fall off due to ageing, i.e.; there was no increase in manual exposure time throughout the testing program.

The lamp blower remains in operation for about 1 minute after the exposure is completed. After the blower initially turns off, it cycles on and off for some additional time. This may prove to be a source of annoyance to persons working in the vicinity of the PIPS.

Variations have been noted in the number of high voltage pulses that are required to ignite the printer arc lamp. In general, the lamp may require eight to ten pulses to ignite when the printer is first operated after a few hours rest. After the printer has been exercised, the lamp will ignite on one or two pulses.

A procedure for periodically checking the correct amount of air bag inflation has been described in para. 5.3.3. A small air pump and a spring gauge which can read a force of 25 pounds are required for this check and should be provided in the event of future equipment procurement.

Double-backed foam tape was used to secure the processor to the mounting surface. This material must be cut away to remove the unit for repair or replacement. Some mechanical means is needed to secure the processor so that it may be quickly and easily removed from the PIPS assembly.

The processor temperature adjustment potentiometer is too sensitive. It is difficult to set the control to the desired processing temperature.

The microstereoscope mounting post assembly is mounted backward on the light table because it would not clear the rear panel. It is awkward to use the microstereoscope translation controls in this position.

5.5 Materials Tests. Limited materials testing was accomplished using the two types of film provided with the PIPS. This testing was partially done by APSD/TSG/NPIC during the course of their operational evaluation. Their test results and the film manufacturers D Log E Curves (see Figs. 10 and 11) are provided for information purposes.

Two operating components voiced concern over the possibility of excessive film shrinkage. TEB designed and initiated a test procedure to determine these film shrinkage characteristics.

5.5.1 Sensitometric Test and Evaluation

TABLE 15. An Evaluation by APSD/TSG/NPIC of [redacted] Materials Furnished with PIPS.

25X1

	DIAZO-POSITIVE	NEGATIVE-DRY SILVER
Emulsion Number	788-9 (Lot 042801)	T-796 (MPX08-23-01)
Dev. Time (Sec.)	105	105
Dmin	0.10	0.12
Dmax	1.30	2.20
Gamma	0.94	1.36
Max Resolution		
Contrast 1:4.57	190 1/mm	240 1/mm
Contrast 1:1.45	130 1/mm	90 1/mm
Subjective Analysis		
Highlight detail	poor	good
Shadow detail	poor	good
Sharpness	fair	good

5.5.2 Film Shrinkage Tests. These tests were performed by exposing test samples of the film on the printer through a Zeiss glass precision grid and subjecting them to normal processing in the heat processor. The resulting printed grids were measured by PHD/IEG/NPIC and the measurements compared to those of the glass grid. The percentage of shrinkage was then calculated from the results.

Relative Orientation of Test Materials for Film Shrinkage Measurements

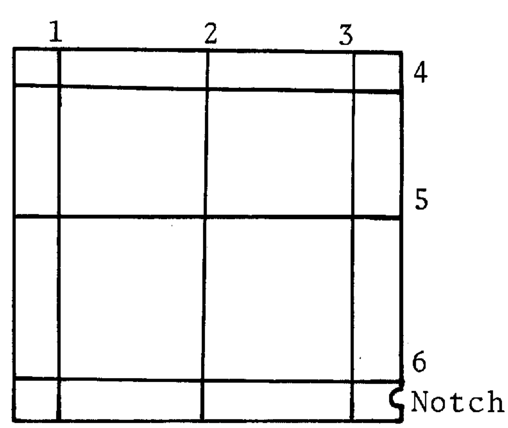


TABLE 16. Film Shrinkage [redacted] Dry Diazo Type 7889 (Lot 28-01) and [redacted] Dry Silver Type 7969 (Lot 23-01) films. 25X1

GRID LINE NO.	FILM SHRINKAGE (PERCENT)			
	DRY DIAZO (Processed 2 Min.)		DRY SILVER (Processed 1.5 Min.)	
	SAMPLE 1	SAMPLE 2	SAMPLE 1	SAMPLE 2
1	0.57	0.60	0.46	0.45
2	0.61	0.60	0.44	0.45
3	0.58	0.56	0.44	0.44
4	0.09	0.10	0.35	0.36
5	0.09	0.12	0.38	0.37
6	0.12	0.12	0.38	0.37

This compares rather unfavorably with [redacted] estar base materials of approximately the same thickness (0.004 inch). As an example, type SO.135 material has a maximum shrinkage of 0.03%. (Reference: Table 9.1 [redacted] Manual of Physical Properties for Aerial and Special Materials.) However, this is still well within the mensuration capability of the P.I., i.e., less than 1%. 25X1 25X1

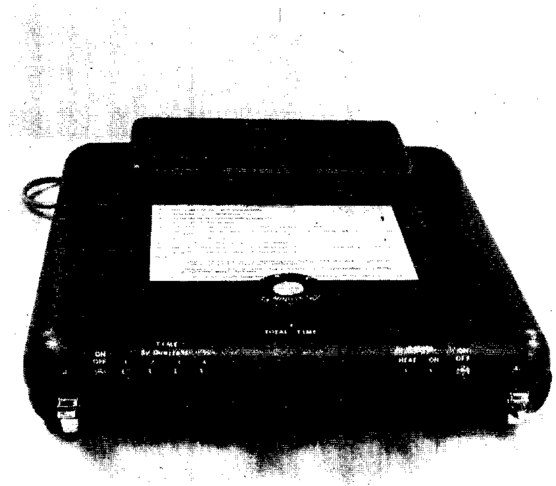


FIGURE 2. DRY PROCESSOR
FINAL CONFIGURATION

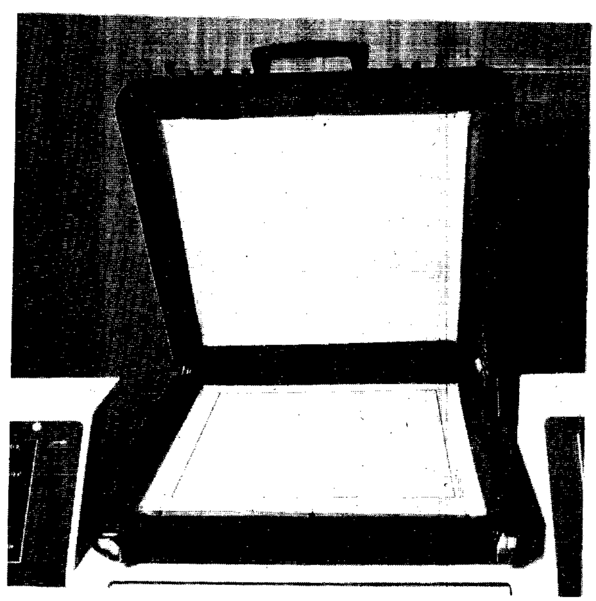


FIGURE 3. DRY PROCESSOR
LID RAISED

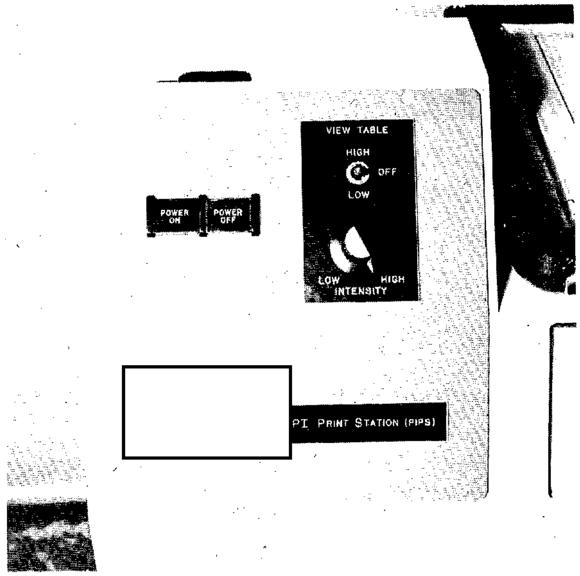


FIGURE 4. LEFT CONTROL PANEL

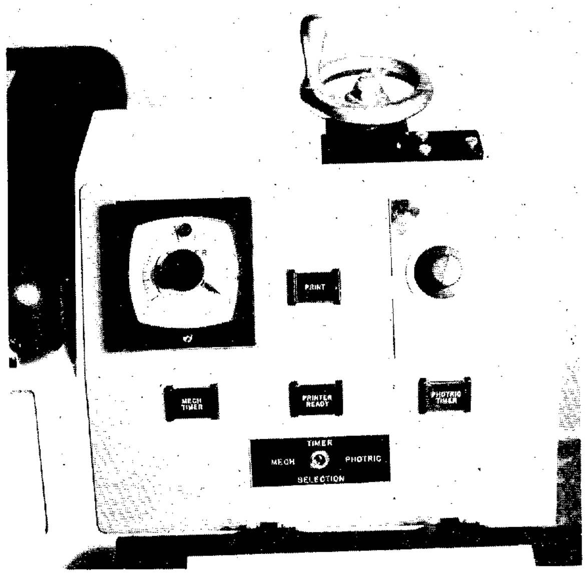


FIGURE 5. RIGHT CONTROL PANEL

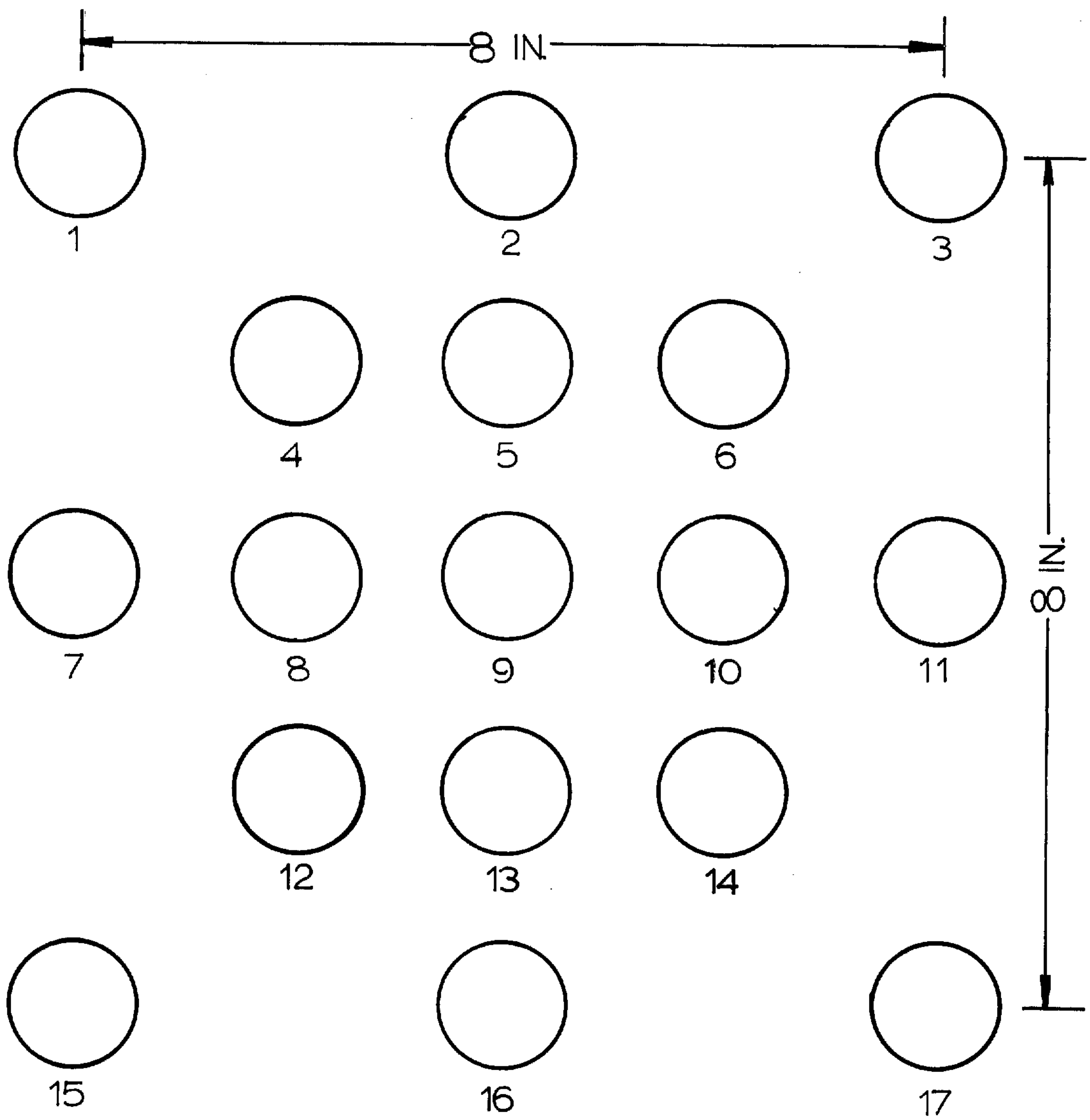


FIGURE 6. RELATIVE POSITION OF USAF 1951 RESOLUTION TARGETS ON ARRAY AND SENSITOMETRIC TEST ZONES

25X1

CONFIDENTIAL

35

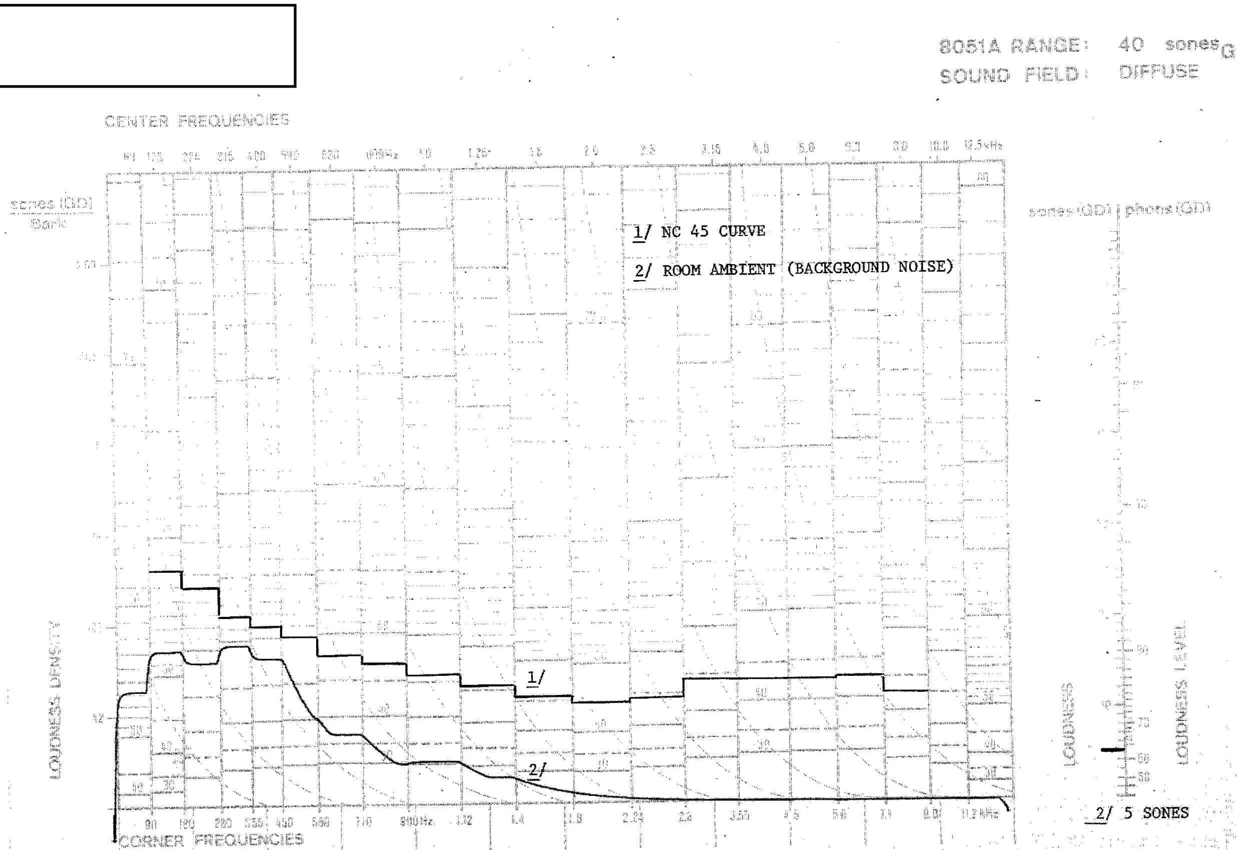


FIGURE 7. FREQUENCY ANALYSIS AND LOUDNESS OF PEAK LEVEL NOISE ROOM AMBIENT (BACKGROUND NOISE)

CONFIDENTIAL

NPIC/R/-32/72

25X1

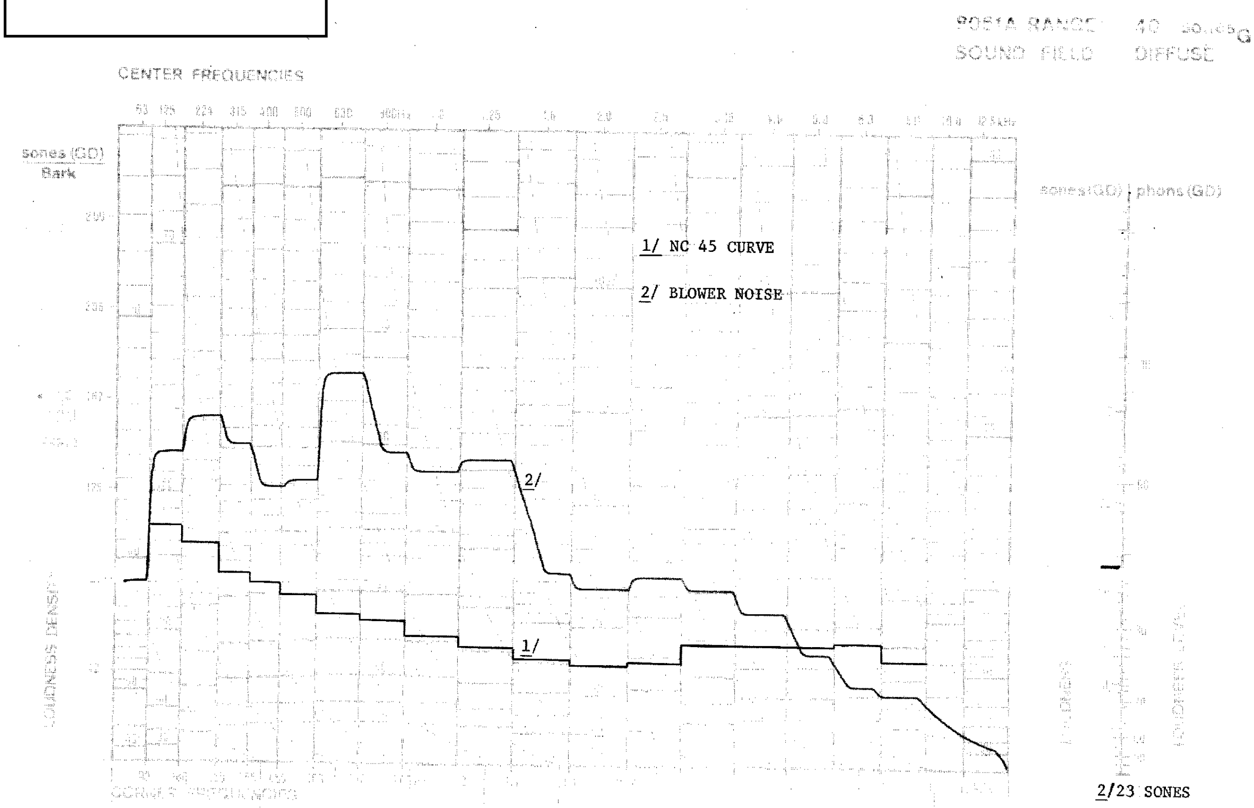


FIGURE 8. FREQUENCY ANALYSIS AND LOUDNESS OF PEAK LEVEL NOISE DURING PRINTING CYCLE

25X1

CONFIDENTIAL

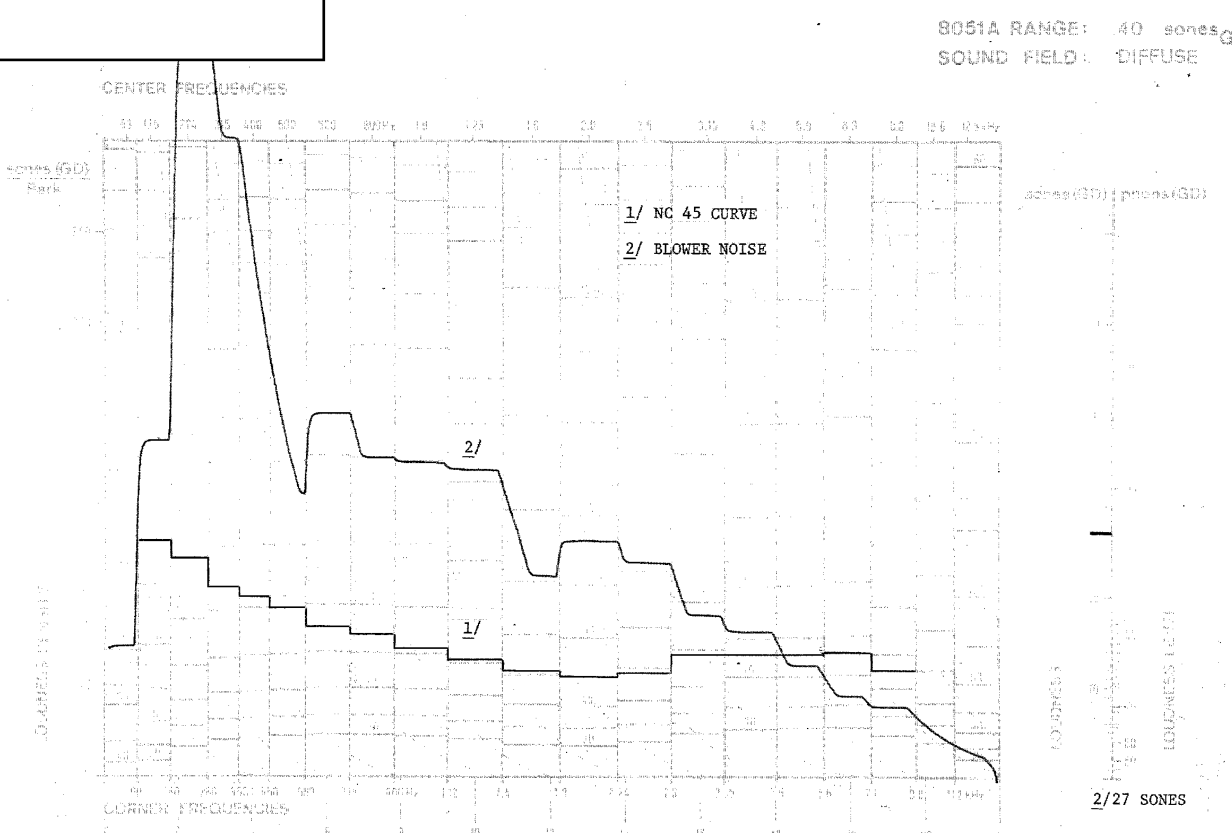
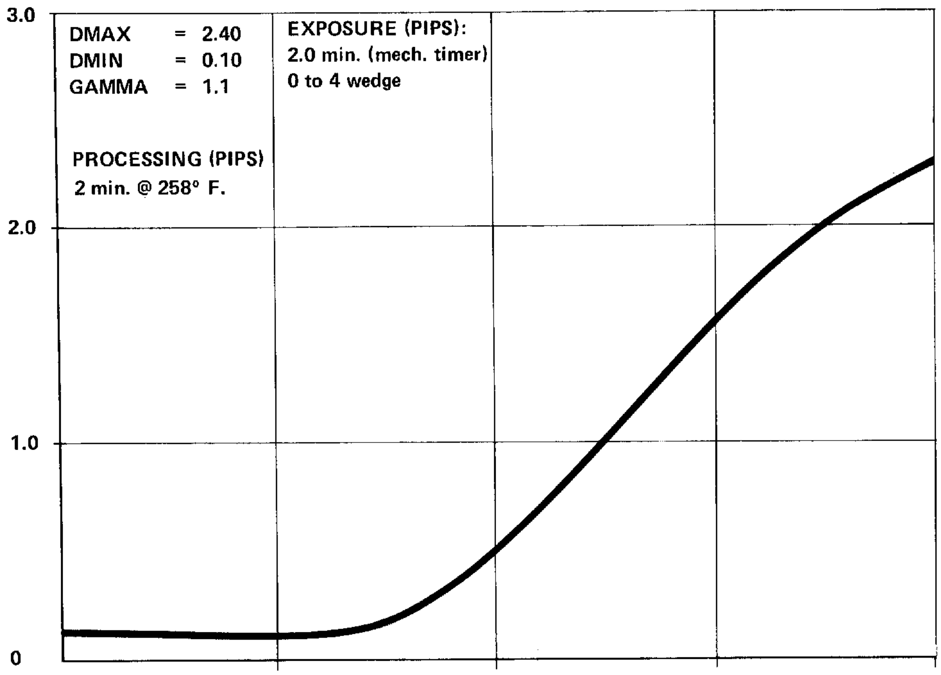


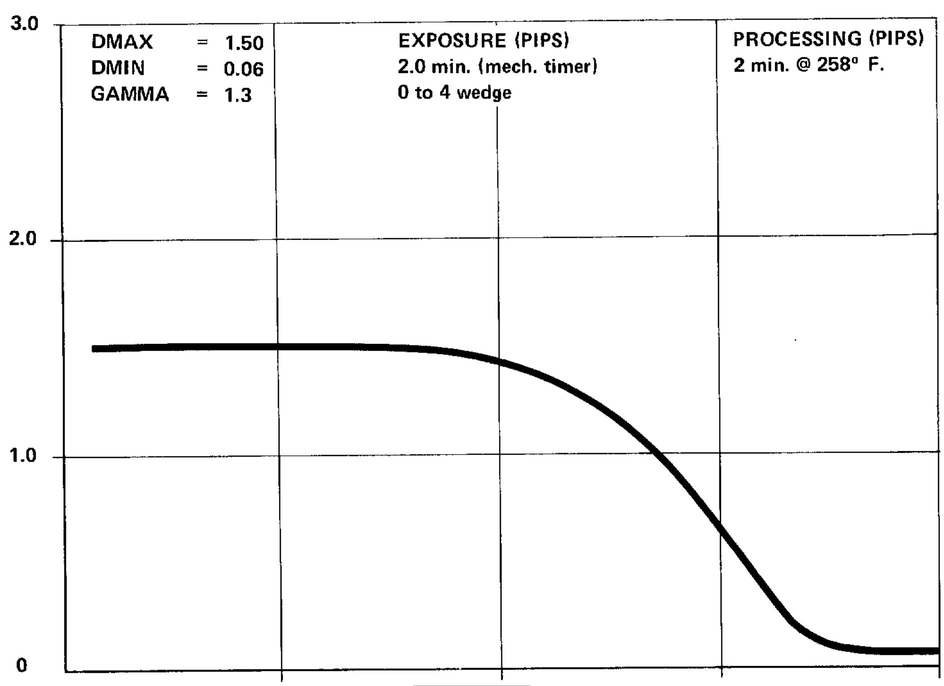
FIGURE 9. FREQUENCY ANALYSIS AND LOUDNESS OF PEAK LEVEL NOISE DURING LAMP COOL DOWN CYCLE

CONFIDENTIAL



25X1

FIGURE 10. D-LOG E CURVE FOR [redacted] TYPE 7969 DRY SILVER FILM (FILM LOT 23-01)



25X1

FIGURE 11. D-LOG E CURVE FOR [redacted] TYPE 7889 THERMA-TONE FILM (FILM LOT 28-01)

Distribution List

Activity	Copies
NPIC/PSG/RRD/DB	3
NPIC/TSG/PPB (thru Ch/TSG)	1
NPIC/TSG/RED/Chief	1
NPIC/TSG/RED/Project Officer	1
NPIC/IEG/OD	1
NPIC/IEG/TPB	1
DDI/IAS/TECH. ADV.	1
DIA/DIAAP-9/Tech. & Dev. Br.	1
ARMY/SPAD/PSO	1
25X1 EXRAND ([redacted] Rm 5S330)	8
NPIC/TSG/ESD	10
NPIC/TSG/ESD/EPB	1
NPIC/PSG/RRD/Library	2
25X1 NPIC/PPBS [redacted] Rm 6N312)	1